

Commonwealth of Virginia
RF Radiation Exposure
Compliance Plan
for
Building- and Tower-based Antenna Sites,
Mobiles and Maintenance

April 1, 2000

Commonwealth of Virginia
Department of Information Technology
110 South Seventh Street - Third Floor
Richmond, Virginia 23219

Commonwealth of Virginia RF Radiation Exposure Compliance Plan

for
Building- and Tower-based Antenna Sites,
Mobiles and Maintenance

Introduction

This document describes the Commonwealth of Virginia's action plan to comply with the Federal Communications Commission's (FCC) human exposure to Radio Frequency (RF) energy regulations. In this document the Commonwealth of Virginia has relied heavily on a Personal Communications Industry Association (PCIA) paper entitled, *Priority Actions for Timely Compliance - Safety Measures for Building-based Antenna Sites* (November 1997); FCC Dockets 96-326, 96-487, 97-303; the FCC Rules and Regulations; the FCC's *OET Bulletin No. 65; A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields*, by the National Council on Radiation Protection and Measurements; and, the viewpoints of experts in the industry, to develop a straightforward and understandable plan that will assure the Commonwealth of Virginia's compliance with applicable FCC regulations.

The FCC environmental regulations are written in terms of limitations on human *exposure* to RF fields *for specific time periods*. The standards do not limit maximum levels of RF energy; they only limit the amount of time that an individual can remain in fields above prescribed levels. As such, compliance is predicated on limiting the duration of human exposure to RF fields (for both workers and the general public) that result from the operation of FCC-licensed wireless systems. (See, 47 CFR § 1.1310.)

This plan addresses a range of effective measures that can be taken to assure that neither workers nor the public are subject to RF exposures above the FCC-specified levels. Although taking such actions may not always obviate the need to measure RF fields or to model predicted RF fields for facilities that are not "categorically excluded," the procedures will provide substantial assurance that a facility does comply with the FCC's RF exposure regulations.¹

The procedures described herein are to be employed at all radio transmitting sites that the Commonwealth of Virginia owns or manages. At sites not owned/managed by the Commonwealth of Virginia, but at which the Commonwealth of Virginia has transmitting equipment; the guidelines in this Plan are likewise to be implemented to the extent possible unless superseded by acceptable site plans developed by the actual owners/managers of the sites or other FCC licensees at the sites. It is the Commonwealth of Virginia's policy to cooperate fully with other licensees at sites to assure site compliance and to maximize the number of its sites that are "categorically excluded" from routine environmental evaluations.

¹ Requirements for categorical exclusion can be found on pages 26-28 of this document (FCC rules, Section 1.1307(b)(1)).

Commonwealth of Virginia

Safety Measures for Building- and Tower-based Antenna Sites, Mobiles and Maintenance

Table of Contents

Introduction	i
Table of Contents	ii
Background	1
FCC Requirements	2
Compliance Actions	6
Identify Problem Areas	6
Restrict Access	8
Training	11
Site Safety Procedures	13
RF Mitigation Measures	15
Site Safety Officer	18
Mobile, Portable, and Special Equipment	19
Mobile Two-Way Equipment	19
Portable (hand-held) Two-Way Equipment	20
Speed-measuring Equipment (Speed Radar)	20
Conclusion	21
Attachments	21
A. October 21 letter from PCIA President Jay Kitchen to Dr. Robert Cleveland, FCC ...	22
B. Dr. Cleveland's reply	25
C. Applicable FCC Rules and Regulations	26
D. Commonwealth of Virginia Site Data Sheet	31

Background

The human radio frequency (RF) exposure guidelines adopted by the FCC are the baseline regulatory requirements for FCC-licensed services. The guidelines have also been adopted by the US Department of Labor - Occupational Safety and Health Administration (OSHA). Electromagnetic radiation is generally treated under OSHA's rules and regulations, Part 29, relating to hazardous materials. The guidelines set specific limits on the duration of human exposure to radio frequency energy as well as require rigorous compliance requirements for certification of transmitting facilities.

Commercial and private mobile radio service (CMRS and PMRS) providers and operators are required to bring their transmitter facilities in compliance with the revised FCC exposure guidelines no later than September 1, 2000, at the time of installation of a new station, or at the time of license renewal or major license modification. At multiple antenna sites, any licensee at the site that passes one of the milestones may trigger site-wide compliance. A number of the Commonwealth of Virginia's sites may be required to be in compliance before September 1, 2000, as other triggering events may occur first.

Using the general approach suggested by PCIA, the compliance options have been divided into five separate components. Each of the components is considered separately, but actual site compliance may involve a combination of actions. The five components proposed by PCIA are:

1. **Access Management**
2. **Personnel Management and Training**
3. **Identification of Problem Areas**
4. **Site Policies for Worker Safety**
5. **RF Mitigation Measures**

IMPORTANT: This document provides practical information for bringing antenna sites into compliance with the FCC RF exposure standards. Due to the complexity of the issue, this Plan cannot cover every aspect and every situation. Source documents from the FCC should be reviewed and studied to obtain a more complete picture of RF exposure requirements. (*See*, FCC Dockets 96-326, 96-487, 97-303; the FCC Rules and Regulations; and, FCC *OET Bulletin No. 65*.) There may also be other measures and approaches that may be effective in assuring that RF exposures do not exceed the applicable FCC limits. Alternative procedures should be coordinated with the Radio Engineer of the Commonwealth of Virginia's Department of Information Technology, 110 South Seventh Street, Third Floor, Richmond, Virginia. 23219, phone (804) 371-5580.

FCC Requirements

On October 15, 1997, the FCC imposed a series of new requirements on licensees of radio transmitting facilities designed to limit human exposure to radio frequency energy. The FCC defined permissible exposure limits in terms of two broad categories.

Accessible/Uncontrolled Areas: Areas in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Occupational/Controlled Areas: Areas in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure.

For each area, the FCC specified levels of RF fields, based on the frequency (wavelength) of the signal, above which exposure times must be limited. To determine how to comply with these regulations, it is important to understand the nature of the health hazard. Radio frequency energy in the wavelengths used for two-way land mobile radio and paging services is “non-ionizing” radiation. Unlike ionizing radiation (x-rays or nuclear energy), which has sufficient energy to dislodge electrons from atoms and cause permanent molecular damage, non-ionizing radiation merely induces heating of the cells in the body. As long as the heating is not excessive, no cell damage will occur.

The amount of cell heating is proportional to several factors: 1) the level of the radio frequency energy, 2) the wavelength of the energy (the body more readily absorbs some wavelengths, as opposed to other wavelengths), and 3) the duration of the time one is exposed to that energy. To keep heating within safe limits, the FCC developed “exposure” guidelines based on these three variables. For energy levels above the FCC prescribed thresholds, human exposure must be limited in duration.

The concept can be visualized by considering a cup of water in an oven. While the oven is on, the water heats. While the oven is off, the water cools back to room temperature. Thus, as long as the “on time” is limited and a “cool down” time is required; the water in the cup cannot exceed a given temperature. This visualization is an extreme example of radio frequency energy heating because of the very intense energy levels inside a microwave oven. Energy levels around typical two-way land mobile and paging transmitters are much lower than inside a microwave oven. Often the levels around antennas can be so low that continuous exposure does not pose a health hazard. It is only when the levels exceed those that could produce excessive heating that precautions must be employed. In fact, the FCC limits are well below those levels that could cause harm. The limits adopted by the FCC allow for the exposure to RF energy based on wavelength, energy levels, and exposure time; however, they do not set values for the maximum levels of RF energy that can be encountered.

For the general public (uncontrolled areas), the FCC established a Maximum Permissible

Exposure (MPE) level based on an exposure time of 30 minutes. In other words, the MPE established for the general public is one that can be encountered continuously for *any* 30-minute period. However, this actually means that the MPE is the permitted *continuous exposure level*. That is, during any “snapshot 30 minute period” the actual RF energy level multiplied by the exposure time in minutes may never exceed the MPE multiplied by 30 ($1\text{MPE} \times 30 = 30\text{MPE}$).

Consider a person in a RF field at the MPE level. No matter when one begins measuring a 30 minute interval, the person can remain in that field because the exposure level (in this case the MPE level) multiplied by 30 never exceeds 30 MPE in *any* 30 minute interval. If, however, the person were in a field equal to twice the MPE level, the maximum exposure would be reached in 15 minutes ($2\text{ MPE} \times 15 = 30\text{ MPE}$). Similarly, if one were in a field equal to three times the MPE, the maximum exposure would be reached in 10 minutes ($3\text{ MPE} \times 10 = 30\text{MPE}$). In this case, the individual could remain in the 3 MPE field for 10 minutes and then have to stay out of the field for 20 minutes. At the conclusion of the 20-minute cool-down period, the person could return to the 3 MPE field for another 10 minutes followed by another 20-minute cool-down period.

For the controlled areas, as defined above, the MPE time is based on six-minute exposure intervals. If a technician were to work in an environment at the MPE limit for a controlled area, the technician could stay in that area indefinitely, as any six-minute period would meet the average (6 MPE). If the technician were to work in a field of twice the MPE limit, the maximum stay could be three minutes with no exposure for the next three-minute period ($2\text{ MPE} \times 3 = 6\text{ MPE}$). The exposure limits for the controlled and uncontrolled areas are contained in Attachment C, FCC Rules and Regulations, Section 1.1310 – Table 1.

The FCC’s table of exposure limits is helpful if actual measurements of the RF fields are being made or predicted. To assist in predicting RF fields, FCC *OET 65* provides two additional graphs that relate effective radiated power to distance to the MPE contour. The first chart (*OET 65*, Figure 1, page 24) is the one to be generally used. It assumes no reflections that could add to the RF field level. This would be the case much of the time on a rooftop, as antennas are normally intentionally mounted in locations that are open and not next to reflecting surfaces. The second chart (*OET 65*, Figure 2, page 25) assumes additive reflections and should be used when such reflections are expected (an antenna mounted at the same level as and adjacent to a reflective wall, such as an elevator penthouse or ground reflections).

The FCC requires that licensees of all transmitting facilities certify that the above exposure limits be met. It is important to keep in mind that compliance is only required in areas that are *accessible*. In areas that are not accessible, like beyond the edges of a rooftop in free space, compliance is not required. However, accessibility at the transmitter site is not the only factor for compliance. For example, if the emission from a high powered transmitter extends beyond free space to an adjacent building, then compliance is required at that building because it is an accessible area even though it is not part of the transmitter site. In areas where exposure is not possible, compliance is not required. As will be shown later, this concept can be used to bring a site into compliance by restricting access to areas having high RF levels.

The date of required compliance varies depending on triggering events, as follows.

<u>Event</u>	<u>Date of Compliance</u>
New Station License	Upon filing of application with FCC
Existing Station	Upon filing of application with FCC
-Modification of License	
-Renewal of License	
All stations	September 1, 2000

In determining whether a facility meets the FCC requirements, three steps should be followed:

- 1) Determine if the station is “categorically excluded” from a routine evaluation.
- 2) If not categorically excluded, perform a Routine Evaluation (RA).
- 3) If the site is not in compliance based on the Routine Evaluation
 - a) bring the site into compliance
 - b) perform a full Environmental Analysis (EA).

The FCC recognized that many stations in the two-way land mobile radio and paging services pose little health hazard and thus allowed for categorical exclusions. Attachment C lists the various exclusions.² For paging, generally any station having an antenna on a tower with the base of the antenna at least 10 meters above ground is categorically excluded. Similarly, a station with a roof mounted antenna or tower mounted antenna having an effective radiated power of 1,000 watts or less is categorically excluded from the routine evaluations. The licensee can presumptively certify compliance to the FCC based on this categorical exclusion. For most private land mobile systems, categorical exclusion is considered for each channel separately, as opposed to the cumulative power of all private land mobile channels at the site.

For stations not categorically excluded, the licensee must perform a Routine Environmental Evaluation. This evaluation will require summing the contributions of all transmitters at a site at all points around and on the site to determine areas in which the sum of the contributions equals or exceeds the MPE for uncontrolled and controlled areas. Areas determined by measurements, manual calculations, or computer modeling to have RF levels above either the controlled or uncontrolled levels can then be brought into compliance and the licensee can so certify compliance to the FCC.³ A less exact alternative for a non-categorically excluded station is to assume that the station is not in compliance and follow procedures to bring it into compliance. For example, access to areas near the antenna could be restricted. But, even in this case, some knowledge of how much area to restrict is necessary.

If the site can not be brought into compliance, the Commonwealth of Virginia, Department of Information Technology and FCC must be so notified by performing a complete Environmental Assessment (EA). The EA fully describes the potential hazards and mitigating reasons why the FCC should grant the application. (It is much better to bring a site into

² Pages 26-28, FCC Rule Section 1.1307(b)(1). The rule actually lists those stations that are not categorically excluded.

³ Procedures to bring a site into compliance are described in later chapters.

compliance than try to justify why it is not, and need not, be in compliance.)

Although the calculations or measurements needed to show compliance can be very complex, sites can often be brought into compliance quite simply by application of the procedures described herein. Warning signs and other restrictions to limit access to high RF field areas will generally be sufficient to bring a site into compliance. Those allowed to enter high RF field areas are required to have training in safe and proper work procedures at such sites and to follow those procedures. It is important to note, however, that a modification by any licensee of a non-categorically excluded station at a multiple-user site will trigger compliance for everyone at that site. One cannot assume that their own modification will be the date of required site compliance. For this reason, it is preferable to initiate mitigating procedures as soon as possible so that actual triggering events for compliance will be no problem for any site user.

It is also possible that even if all antennas at the site are categorically excluded, the site may not actually be in compliance, as the contribution of all transmitters may cause power densities in excess of the FCC limits. *Categorical exclusion from routine evaluations does not relieve a licensee from being in compliance with the rules.*⁴ At multiple-user sites, the licensee of any antenna that produces a field equal to five per cent or more of the MPE for that frequency in any area of non-compliance must share in bringing the site into compliance, even if that station is categorically excluded. (Note: This is not five per cent of the field at the location in question, it is five per cent of the allowable MPE for that station.) If there is any question as to site compliance, a routine evaluation should be performed. In most cases, the routine evaluation will be done using computer modeling software owned by the Commonwealth of Virginia or by an independent contractor selected by the Commonwealth.

Site owners and managers do not have responsibility for site compliance under the FCC Rules and Regulations, but owners and managers can be very helpful in the compliance process. At multiple-user sites, information must be obtained from all users, even if that information states that all users are categorically excluded - *without exception*. If a Routine Evaluation is required, considerable data regarding each user must be available. (Attachment D shows an example of the type of data that will be needed for each user at the site.) At some sites, it may be advantageous to utilize the services of a competent third-party contractor to assist in the certification process.

⁴ See, FCC OET 65 at page 12, which states, "It is important to emphasize that the categorical exclusions are *not* exclusions from *compliance* but, rather, exclusions from performing routine evaluations to demonstrate compliance."

Compliance Actions

1. Identify Problem Areas

Areas at a site in which the RF power densities equal or exceed the controlled or uncontrolled levels shall be identified.

Sites having stations not categorically excluded from routine RF evaluations must be analyzed to determine the boundaries of the controlled/occupational and uncontrolled/general public areas using the basic procedures found in FCC *OET Bulletin 65*. Such evaluations must also be performed for sites having all transmitters that are categorically excluded if there is reason to believe that hazardous levels of RF energy may be present due to the addition of individual fields.

When power densities exceed the general public (uncontrolled) MPEs, every effort shall be made to prevent access to such areas by personnel not trained in RF awareness. (See Section 2 - Access Management.) If access cannot be prevented, then appropriate signs must be posted to alert the general public of the potential hazard. (Note: It is Commonwealth of Virginia's policy to take measures necessary to limit RF levels in uncontrolled areas to below the FCC limit rather than post signs warning of the hazard, even if this means repositioning antennas or reducing power.)

In areas in which power densities may or do exceed the occupational (controlled) MPEs in accessible areas at a site, any personnel entering the area must be trained in RF awareness. They must also be made aware of the locations of such areas and take appropriate measures to assure that they will not be exposed to RF fields above the MPE time-averaged limits. To be sure that workers know when they may be subject to high RF levels, the areas where such excessive exposures are possible must be identified. There are various ways this can be done, such as:

- (a) **Permanent demarcation of hot spot areas (accessible areas where power densities could exceed the controlled/occupational environment MPE limits) with signs or floor markings:** Signs or floor markings (or both) can be effective in alerting personnel of areas where RF fields may be excessive. In determining where RF fields may be at levels in excess of the controlled MPE limits, the determination can be based on calculations that factor the applicable variables for prediction of RF fields in the immediate proximity of the radiator (including transmitter power, frequency, antenna gain, etc.), on actual measurements, or on computer modeling. When relying on actual measurements, care must be taken to assure that all transmitters are radiating while the measurements are being made. Procedures described in FCC *OET 65* should be followed for determining hazardous areas. Generally, the Commonwealth of Virginia should rely on actual measurements to locate hot spots. Computer modeling will be used to identify

areas that have no potential of a safety hazard.

Caution: Snow can hide floor markings: In situations where snow could cover floor markings, the demarcation process should not rely solely on floor markings to keep personnel out of “hot spot” areas (accessible areas where power densities may equal or exceed the workplace guidelines), agencies could also install some type of vertical perimeter marking to deal with this situation. Diagrams of the area that clearly show the hot spots should be posted in areas protected from the environment.

and/or

- (b) **Establish three (3) foot (minimum) safety zones from any radiating devices:** Alternatively, for most land mobile antenna facilities, a widely accepted rule of thumb is that establishing a 3 foot safety zone (radius) around any omnidirectional antenna or a 3 foot zone in the transmitting direction of sectorized antenna, will generally provide an adequate safety margin.

Important caveat: *In some situations, antennas may merit a safety zone of more than three (3) feet.* Examples are higher power/lower gain antennas or broadcast antennas that can produce high RF fields in the immediate vicinity of the antenna. In such cases where the safety zone should be extended, the responsible Commonwealth of Virginia licensee should ensure that the appropriate measures are taken to alert workers of the locations of such potentially high RF fields.

and/or

- (c) **Use of personal monitoring devices:** Personal monitoring devices may be used by those who have occasion to work near or in the vicinity of radiating antennas. Typically, such devices are set to emit an alert when overall power densities are above the standard for a controlled environment exposures. As a matter of Commonwealth of Virginia site policy, personnel must wear personal monitoring devices at sites where there is any question as to the safety of RF levels to be encountered. Anyone needing such a device should contact his/her supervisor.

COMMONWEALTH OF VIRGINIA PERSONNEL - REQUIRED ACTIONS:

At all sites at which Commonwealth of Virginia has transmitting equipment not categorically excluded from Routine Evaluations, the responsible licensee shall take appropriate measures to identify all areas in which the RF levels equal or exceed those specified by the FCC for human RF exposure, both for controlled and uncontrolled areas, unless such determination has been made by the site owner/manager and Commonwealth of Virginia can reasonably assume the accuracy of such determination. Determinations can be made by calculations, actual measurements of fields, the “three foot rule,” or computer modeling. As a minimum, once “hot spots” have been identified, signs shall be posted to alert workers at the site of the potential for exposure to high RF fields and the need to take steps to limit exposure in such areas. Also a sign shall be posted at the location of ingress

into the area of high RF fields to alert anyone entering the area that personal monitoring devices must be employed. If needed because of snow or other conditions, site maps showing “hot spots” shall be posted in protected areas near the point of ingress to the site.

2. Restrict Access

Sites should be managed in a manner such that only duly authorized or appropriately “cleared and trained” persons have access to any area or portion of the site where RF fields could cause exposures that exceed the FCC uncontrolled/general public environment limits. Such access management measures generally will involve prominently demarcating or (preferably) separating such areas from any publicly-accessible area.

Controlling access: Access to any areas where RF fields could exceed the FCC-established maximum permissible exposure (MPE) limits for the general public should be restricted or limited. This restricted area would generally be considered the “controlled” environment. The preferred method is to physically restrict access to the area and to limit the distribution of keys only to authorized personnel (which could include approved and trained contractors and their employees). Tower bases should be appropriately fenced so as to prevent unauthorized persons from climbing the tower and coming in contact with high RF fields.

At some multiple-user, rooftop-based sites, it may be useful (although not always possible) to establish a controlled environment that is made up of only a portion (or portions) of the entire rooftop. This may make it possible for other activities, (such as building repairs, servicing of air conditioning units, etc), by persons who have not had RF awareness training to take place on the uncontrolled areas of the roof. To configure a rooftop successfully to include both controlled and uncontrolled areas, the controlled areas must be clearly demarcated with prominent signs (as well as floor markings in some situations) or fenced off to prevent unauthorized persons (or anyone without the necessary RF awareness or safety training) from entering any controlled area.

Authorization of personnel: Only authorized persons should be within the controlled area. Authorized persons should, at a minimum, have received basic awareness training in RF safety. The Commonwealth of Virginia provides such training for all of its employees who must enter controlled areas in the performance of their work. The authorization requirement also must apply to personnel who may not be affiliated (either as an employee or a contractor) with the Commonwealth of Virginia. Accordingly, personnel such as window washers, HVAC technicians, etc. will either need to have the RF awareness training if they must work in controlled environment locations or must be escorted by a trained Commonwealth employee. The Commonwealth of Virginia can arrange for training of others that need access to controlled areas. For towers, any personnel climbing a tower must be fully trained in RF awareness. (The Commonwealth of Virginia will accept evidence of adequate training having been received from wireless carriers, trade associations, technical schools, etc., but a certificate of successful completion must be provided to the Commonwealth of Virginia.)

Controlling access with signs: In some situations, local building codes may preclude locking doors that provide access to a rooftop. In such cases, installation of an alarm system should be considered at the ingress point to alert anyone entering the area (such as through the

doorway) that there may be portions of the building or rooftop where special precautions may need to be taken. Under such circumstances, there should be prominent and distinctly visible signs to alert any person entering the area. Signs should be placed at the base of all towers alerting people to the potential RF hazards on the tower. All RF hazard warning signs shall include ANSI-approved hazard markings. Such signs will generally be obtained from commercial vendors or a Commonwealth of Virginia sign shop and adapted to each situation, as required. It should be noted, that posting a sign at a transmitter site, describing a hazard that does not exist, could cause an undesired action by local residents or personnel employed near the site. Therefore, proper measurements must be taken to determine a hazard exists prior to posting any signage.

Providing information with signs: Under some circumstances, signs might be used to provide information about any potential hazard at the site. Signs can also relay simple instructions, such as describing what floor markings mean. In areas of the state where snow may obliterate floor markings, signs in areas protected from the environment should show the diagram of the rooftop clearly depicting the controlled areas. Agencies could also install some type of vertical perimeter marking to deal with this situation

It is important to provide information about who to contact regarding the site or an individual transmitter or antenna. For Commonwealth of Virginia owned sites, two telephone numbers should be shown on a sign at the point of ingress to the site. The first will be the name and contact number of the site safety officer. This will generally be the technician primarily responsible for the site. The second will be for the Agency responsible for the site or default to the Department of Information Technology in Richmond, phone (804) 371-5580. For non-Commonwealth of Virginia owned sites, it is preferable to have the contact point be the site owner/manager. In all cases, all Commonwealth of Virginia transmitters will have the information about how to contact the site safety officer and the Agency or the Department of Information Technology clearly displayed on the exterior of the equipment cabinet.

In situations in which a contractor or building worker must work in a controlled environment, signs and/or floor markings can be used to advise the worker that only properly trained individuals are authorized to be at the location. If training or express permission to enter an area would be necessary, the signs also could provide the local phone number for a Commonwealth of Virginia technician, the building/tower owner, or site manager, and advise the reader to call and receive specific instructions or guidance before working at the site.

At some building-based/rooftop sites, the controlled environment areas (areas where exposures could equal or exceed the general public MPE limits) can be limited to specific, demarcated portions of the rooftop. On these types of rooftops or buildings, workers who have not undergone awareness or other RF related training may work in only those areas that have not been restricted (i.e.; controlled), as long as effective measures are in place keep workers away from the controlled areas.

There is not a single universally-acceptable approach for managing or controlling unaffiliated workers who may need to be at a controlled area in a manner that would be appropriate for all buildings/towers and all the variations of management arrangements that exist. To the greatest possible extent, such workers should not be allowed in a controlled area without

either proper training (see Section 3) or unless accompanied by a trained technician.

Role of the building/tower owner or manager: For purposes of compliance with FCC human exposure guidelines for RF energy, the obligation falls to the FCC license holders for a site. Building/tower owners and managers who do not hold a FCC license at the site are not subject to FCC enforcement action. Building/tower owners and managers who have employees may, however, be subject to enforcement of workplace safety rules by the Occupational Health and Safety Administration (OSHA). The Commonwealth of Virginia believes that the site owners/managers can play a pivotal role in helping all site occupants to come into compliance with the FCC's RF exposure guidelines. For Commonwealth of Virginia sites, the Commonwealth of Virginia will take a lead role in helping tenants assure compliance.

Potential role of a competent third-party or specialized site manager: Many multi-user, transmitter sites are being managed by specialized facility management companies. An increasingly encountered arrangement is where the owner of the building/tower contracts with a specialized site management company to optimize the use (and revenue generating capacity) of a rooftop or building. On multi-transmitter sites, a competent site manager can simplify or streamline the overall RF compliance process for all licensees with antennas at the site through such means as developing and enforcing site access procedures, identifying possible hot spots, coordinating and enforcing worker safety practices, and maintaining technical and operational data for all transmitters and antennas in service at the site, and providing the actual site certification.

Where a competent third-party site manager can effectively coordinate, manage, and certify compliance of a site, the Commonwealth of Virginia will rely on such certification of compliance. The third party certification should be sufficient for licensing or renewal purposes as long as the Commonwealth of Virginia has a reasonable basis for accepting the report or representations of the delegated party. At the same time, this in no way negates the Commonwealth of Virginia's ultimate responsibility for compliance with the RF exposure rules.

COMMONWEALTH OF VIRGINIA PERSONNEL - REQUIRED ACTIONS:

Where possible, at all sites at which Commonwealth of Virginia has transmitting equipment, access to areas in which RF levels exceed those specified by the FCC for general public/ uncontrolled areas should be appropriately limited to personnel who have been trained in RF exposure awareness. Where possible, doors providing ingress to such areas shall be locked and/or the perimeter of such areas shall be fenced. As a minimum, the technician responsible for each site shall assure that signs are in place to mark areas that have RF energy levels that equal or exceed those defined by the FCC Rules and Regulations for uncontrolled areas. (Floor markings may also be appropriate.) If floor marking is not possible to identify specific hot spots, the point of ingress shall have a sign in place warning of the RF hazard and personnel entering the area should utilize personal monitors. RF hazard warning signs shall be installed at the base of all towers. In addition, other signs that provide instructions or contact point information shall be posted, as needed. At Commonwealth of Virginia owned/managed sites, the contact point numbers to be posted shall be as described above. At both Commonwealth of Virginia owned/managed sites and those not owned/managed by Commonwealth of Virginia, each Commonwealth of Virginia

transmitter shall be marked as described above.

3. Training

All personnel who must enter into any area where power densities could exceed the uncontrolled or general public exposure limits should be appropriately trained or instructed. Depending on particular circumstances, such training could range from a basic or minimal awareness training to more extensive instruction for workers who may be subject to higher RF fields as a result of servicing or maintaining telecommunications equipment.

All personnel who have occasion to work in a controlled area, where power densities could exceed the general public MPE limits, should be aware of the potential for their exposure to RF fields and should be informed as to the steps they can take to ensure they will not be exposed to RF fields in excess of the MPE limits. The FCC regulations also consider that personnel who are only present as a result of transient passage (such as a building maintenance worker walking through -- and not necessarily spending time in -- a controlled area) should be "made fully aware of the potential for exposure [so that he/she] can exercise control over his or her exposure by leaving the area or some other appropriate means."

RF awareness training: Personnel who must have awareness training include employees of the Commonwealth of Virginia who must work at transmitter sites, similar employees of other licensees, and employees of outside contractors performing telecommunications-related service. In addition, non-affiliated workers (those not performing a telecommunication function or who work as employees or contractors working for the building owner/manager) must be trained if they must enter the controlled areas or they must be escorted by a trained Commonwealth employee.

RF awareness training should impart broadly applicable principles for working safely near energized communications antennas and equipment as well as guidance for personal protection that will be encountered under specific workplace conditions. Safety principles that are nearly universally applicable include:

- (a) **In general, personnel should assume all antennas are active and energized.** Unless a worker has direct knowledge that an antenna is either a receive antenna or has been deactivated, the worker should consider antennas to be active and energized. (Receive or non-radiating antennas are sometimes identified with signs at the bottoms of the antennas.)
- (b) **Personnel should habitually maintain a minimum distance of three (3) feet from an antenna. In some cases, antennas should be given more than 3 feet clearance** (in such instances, appropriate signs and other warning must be posted to indicate the necessary clearance).
- (c) **Personnel should obey all posted signs and warnings.**
- (d) **Personnel should not stop near omnidirectional antennas or in front of** (within the transmit zone) **directional antennas, and should keep below**

elevated antennas.

The Commonwealth of Virginia provides training for its employees and will arrange for training of non-associated employees who must work in controlled areas. As a minimum, any personnel needing to enter controlled areas should watch the video tape on antenna site safety produced by Motorola Network Services and Ric Tell Associates. A copy of the tape is available from the Department of Information Technology in Richmond.

Some workers may require additional knowledge and training: RF awareness training is generally considered the baseline for what workers/ employees/ contractors or other personnel should have had if they must enter a controlled environment. In some situations, this training may not be appropriate for individuals not involved in a telecommunication function (for instance, they might be an air conditioning technician or a building maintenance worker). The basic instruction should generally include guidance for recognizing and avoiding areas where high RF fields may be present. As such, the baseline awareness training may not necessarily be elaborate or extensive, as long as it is effective in providing workers with the information and guidance they need to avoid exposure above the MPE limits.

The amount and intensity of safety training for personnel should be commensurate with their potential to be exposed to RF as a course of performing their job. At a minimum, training should be sufficient to enable workers to recognize all potential situations where they could potentially be exposed to excessive RF fields and to be able to take the necessary action and use the appropriate tools to protect themselves. Communications technicians should, in addition to watching the video tape referenced above, review FCC *OET 65*. The Commonwealth of Virginia will additionally periodically schedule training classes for technicians at various locations throughout the state.

COMMONWEALTH OF VIRGINIA PERSONNEL - REQUIRED ACTIONS:

All Commonwealth of Virginia employees who must work in environments in which the RF energy may equal or exceed the levels defined by the FCC for uncontrolled areas shall be trained in safety procedures. Any technician who has not had such training, as provided by the Commonwealth of Virginia, shall contact his/her supervisor to obtain such training. In addition, all technicians are expected to review FCC *OET 65*. Any non-associated workers who must perform their work in a controlled environment shall, at Commonwealth of Virginia owned/managed sites, receive appropriate training in limiting exposure to RF fields by, as a minimum, being provided with the Motorola/Ric Tell and Associates video training tape. At sites not owned/managed by the Commonwealth of Virginia, such workers may be trained in a similar manner, but preferably by the site owner/manager. In lieu of training of non-associated workers, such workers may be escorted into controlled areas by trained personnel. One exception to the above is the following: The Commonwealth of Virginia at some sites have co-located contracts with commercial wireless corporations that allow unescorted access to controlled areas. At these locations it is the responsibility of the contractor to ensure compliance to the FCC regulations regarding R.F. Radiation Exposure, not the Commonwealth of Virginia.

4. Site Safety Procedures

Personnel working in areas where RF fields may equal or exceed the controlled environment/ occupational limits must use appropriate hazard-avoidance workplace measures. The fundamental safety measure for servicing an antenna should be to deactivate the unit. Depending on other circumstances, such as whether prevailing RF fields still equal or exceed the worker MPE limits after the antenna is deactivated, other measures may be necessary to ensure worker safety:

The following procedures should be followed at all times at a transmitter site:

- (a) **Deactivate antennas:** An antenna and transmitter should be deactivated prior to being serviced.
- (b) **“Lock out/tag out” transmitter:** The transmitter of an antenna being serviced should be tagged (lock out/ tag out) to keep it from being activated while personnel may be servicing the antenna.

Limited exception to (a) and (b): In some situations involving low-power directional antennas, it may be possible for personnel to make minor adjustments from the rear of the antenna without subjecting the service personnel to fields that are in excess of the guidelines. In order to perform such adjustments, (such as down-tilt and minor azimuth correction), personnel must be able to approach the antenna from the side or the rear so that they do not enter into the transmit path of the antenna.

Deactivating nearby antennas: In some multiple-user situations, even after an antenna being serviced is locked out, workers still may be subject to RF fields in excess of the controlled limits from the output of nearby antennas. Under such conditions, one way to reduce power densities in the area may be to have other antennas deactivated. As a practical matter, this may not always be possible if the antennas are the property of or are operated by other parties. In these cases, workers will need to take additional precautions; such as in (e), (f) and/or (g) stated below.

- (c) **Operating Transmitters without shields:** Shielding on transmitter power amplifiers is designed to contain RF energy and to prevent excessive RF fields in certain areas in the immediate vicinity of the transmitter. Removal of the shielding from a transmitter could significantly increase the power densities in the vicinity of the transmitter. If shields are removed during servicing, they should always be replaced.

Personnel at a site should also be mindful that some transmitters might be operating with faulty or missing shielding. Such transmitters could generate high RF fields in the transmitter room. Personal RF monitors are recommended for use, as noted in paragraph (f) below, in the vicinity of both transmitters and

antennas to assure that exposure guidelines are not exceeded. In some cases, it may be necessary or prudent to have the power to an unshielded transmitter locked out/ tagged out while service is being performed on a neighboring or adjacently located antenna.

- (d) **Antennas in equipment rooms shall not be activated.** Transmit antennas should never be operated inside the equipment room, even for short term testing. This includes mobile magnet mount antennas attached to the top of transmitter cabinets as temporary installations. Any testing of transmitters should be done with the transmitter connected into a dummy load or with the transmitter connected to an antenna that is a safe distance from any personnel.
- (e) **Servicing equipment in radio shops:** The above procedures apply equally to activation of transmitters in radio shops. Particular care should be taken to assure that transmitters are not connected to antennas in the shop. Such antennas could expose a number of workers in the shop to high RF fields. Use of dummy loads is the preferable method to work on transmitters. This also prevents the possibility of over-the-air interference from an activated transmitter. If transmitters must be tested with shields removed, such testing should be done in an RF tight test bay or screened room. Personnel should not be in the same test bay or screened room when the transmitter is activated. If that cannot be avoided, personnel should wear personal monitors and limit the duration of exposure. Hands and other parts of the body should be no nearer such equipment than absolutely required and then only for very limited duration.
- (f) **Tower maintenance:** Personnel who must maintain antennas on towers need to observe the same general safeguards as others who work around RF equipment. However, towers pose some special problems. On a rooftop, one may be able to avoid coming in close proximity to antennas that are producing high RF fields by simply choosing an alternate path. When climbing a tower, there is only one path, straight up, meaning workers necessarily come close to the antennas. It is preferable to deactivate any antenna that a worker must pass on the journey up the tower. If that is not possible, the worker should be alert not to stop at any point on the tower that is in the major beam of any active antenna. Personal monitors should be worn. In some cases, in extremely high RF field areas, workers should consider use of RF protective clothing.

Additional measures that can be effective in reducing worker exposures or assuring a safer workplace environment (not applicable to all situations):

- (g) **Use of personal protective equipment/ RF protective clothing (PPE):** Appropriately selected and properly used RF protective clothing can be effective in reducing whole-body RF absorption. When RF protective clothing is worn, it is important that the full range of precautions pertinent to such situations be followed and that workers have the requisite understanding of what could impede the protective qualities of the RF protective suit, including the compatibility between frequency range of the suit and any specific exposure situation, wear and

tear on the suit, how to wear the clothing properly, etc.

- (h) **Use of personal monitoring devices:** Personal monitoring devices may be used by personnel (employees, contractors, others) who have occasion to work near or in the vicinity of radiating antennas or transmitters. Personnel using such devices should be trained in their use and must comply with specific safety policies if (when) their device detects high RF fields.
- (i) **Use of time averaging:** FCC exposure limits for a controlled/occupational environment specify that time averaging techniques should be based on 6-minute intervals. (See *OET Bulletin 65* for details of how to apply time averaging.)
- (j) **Prominent posting of site-specific or general hazard avoidance procedures for workers:** Even though personnel at a site will generally have had RF awareness training, there may be special circumstances that merit additional notification or information about conditions that may apply to the site in question. Beyond this, important safety messages may merit repetition and additional emphasis.

COMMONWEALTH OF VIRGINIA PERSONNEL - REQUIRED ACTIONS:

All Commonwealth of Virginia employees who must work in environments in which the RF energy may equal or exceed the MPE levels defined by the FCC for uncontrolled areas must follow the above procedures to minimize or eliminate the potential for exposure to high RF fields. Non-affiliated workers who are allowed in areas having RF levels exceeding the uncontrolled MPE should be made aware of these procedures and likewise follow them when working in controlled areas. Any actions that may result in a disruption of service at a given site should be coordinated fully with end users of the system.

5. RF Mitigation Measures

To assure site-wide compliance at some multi-user sites, it may become necessary to make changes of a technical, engineering or physical nature. Such changes would be made with the intent of providing the necessary assurance that neither workers nor the public would be exposed to RF fields in excess of the applicable MPE limits. The Commonwealth of Virginia desires that the general public not be permitted access to areas in which the RF levels equal or exceed those specified by the FCC for uncontrolled areas. In addition, no tower-mounted antenna should be mounted on the tower with its base less than ten meters above ground. Examples of RF mitigation measures include:

- (a) **Elevate antennas:** Elevating (raising) rooftop antennas can substantially reduce the power densities that are present at accessible areas on a rooftop.

* Placing or mounting antennas at a height above head level (approx. 7 feet or 2 meters) can substantially reduce the power densities that are present at accessible areas on the rooftop. This procedure is especially useful for rooftops where multiple rows of omnidirectional antennas are located.

At sites with towers, no antenna should be mounted with its base less than 3 meters (10 feet) above ground. (Categorical exclusion requires mounting at no less than 10 meters above ground.) Care should be exercised to assure that raising an antenna does not cause the antenna/structure to exceed the height authorized by the FCC and FAA. In addition, raising the antenna may require a modification of the station license.

- (b) **Reduce power of antennas:** By lowering power to the antenna, cumulative RF fields at the site, as well as in publicly accessible areas, may be lowered. This may facilitate overall site-wide compliance.

Powering down may enable some facilities to qualify for a categorical exclusion designation -- which can relieve the licensees, including the Commonwealth of Virginia, from the FCC's requirement for performing a routine environmental evaluation. Additionally, in situations where total power densities exceed the MPE limits at any accessible area (either publicly or workplace accessible), if the output power of an antenna produces less than 5 per cent of the maximum permitted power density (based on its service category) at all accessible areas, the licensee would not share responsibility for site-wide compliance.

The Commonwealth of Virginia's general policy is that the ***ERP of an antenna should not exceed 1,000 watts unless the antenna is tower-mounted with its base more than ten meters (33 feet) above ground level***, thus qualifying the station for a categorical exclusion. Reduction in ERP can be by reducing transmitter power, reducing gain of the antenna (replacement by a lower gain antenna), or a combination of both actions. Such power reductions can, however, have a negative effect on the coverage area of a station and could potentially require the installation of satellite sites to make up for the reduced power.

Special note: Workers should take appropriate precaution in the immediate area of "categorically excluded" antennas: Categorical exclusion from performing a Routine Environmental Evaluation does **NOT** mean that the subject antenna will comply with FCC rules on human exposure to RF fields. Even if antennas are categorically excluded from routine environmental evaluation, RF fields in their vicinity can still exceed the MPE limits for worker exposure. Categorical exclusion does not relieve the Commonwealth of Virginia or any other licensee at a multi-user site from an obligation to comply with the exposure limits. In fact, unless appropriate measures are taken to mitigate potentially excessive worker exposure at some categorically excluded antennas, the facility will technically not be in compliance with the FCC human exposure rules. Categorical exclusion does not eliminate the requirement for the site to be in compliance with the FCC exposure limits.

For example: Consider a 1,000 watt ERP, six (6) foot paging antenna driven with a 300 watt transmitter at 835 MHz. Such a system would be expected to produce a spatially-averaged RF field equal to the controlled/occupational environment MPE limit of 2.78 mW/cm^2 at a distance of 3.1 feet from the

antenna.

However, if the transmitter power was increased and the antenna gain was lowered, the area around the antenna where the spatially-averaged field would exceed the controlled/occupational environment MPE limits could easily double. The use of three-way and four-way antennas could further exacerbate the problem by extending the distance from the antenna where the resulting power densities could exceed the controlled MPE limits. Generally, use of higher gain antennas and lower transmitter powers minimizes the spatially-averaged field.

- (c) **Reposition/ relocate antennas:** The placement of individual antennas and arrays may affect the power densities that will be found at various locations at and around the site. Consideration should be given to traffic passageways that workers or employees would use while on the site so that personnel can traverse the site and maintain a minimum distance of three feet or more from any non-elevated antenna.

Directional antennas or arrays should either be placed along the outside peripheries of the site with the beam of the transmitter directed away from the building or facade mounted (so that the main beam is not directed on any accessible areas).

- (d) **Increase spacing between antennas:** In locating multiple antennas on heavily used rooftops, whip antennas are often placed in multiple rows that (when viewed from above) form a grid. The spacing between antennas will affect the power densities at the various locations at the site. Where the antenna density in the grid is high (minimal distance between antennas), the power densities at any point on the site are likely to be high. Increasing the distance between antennas can be effective in reducing prevailing RF fields in some controlled area locations. In general, when antennas are placed less than 10 feet apart, workers may need to use protective measures (e.g., reducing power, wearing protective suits, etc.) or use monitoring devices when working or traversing areas where antennas are clustered. This is especially true at sites where antennas are not elevated.

Site Safety Officer

All sites must have a designated site safety officer who takes responsibility for RF Exposure compliance. Once designated, the site safety officer shall notify the Department of Information Technology of the designation. The site safety officer will generally be determined by the responsible agency of the Commonwealth of Virginia. The name and telephone number of the site contact person shall be posted at the site, as described in Section 2 of “Compliance Actions,” page 9.

The site safety officer is responsible for determining if the site is in compliance with the FCC RF exposure regulations either through a determination of categorical exclusion or through a routine evaluation and implementation of mitigating measures. The site safety officer may determine that even facilities with all categorically excluded stations may require a routine evaluation. The site safety officer can request assistance from the their agency or Department of Information Technology in performing the routine evaluation.

The results of all determinations, including copies of any routine analysis that may have been performed, shall be maintained by the site safety officer with a copy forwarded to the responsible agency or Department of Information Technology. Major changes at a site required a new determination, for example, adding a new transmitting facility.

The site safety officer should be prepared to show and defend both the compliance determination and continued site compliance to authorized representatives of the Federal Communications Commission, the Occupational Safety and Health Administration, or the Environmental Protection Agency.

Mobile, Portable, and Special Equipment

Much of the radio equipment operated by the Commonwealth of Virginia is in a field environment. This operation consists of use of vehicle-mounted transceivers, low- and high-powered portable transceivers, and speed-measurement Doppler radar units. These units generally pose no RF exposure hazard when operated because of either their low transmit duty cycles or low power. However, it must be realized that these devices are almost always being operated in the uncontrolled environment. Thus procedures must be sufficient to protect the general public from excessive RF exposure. For more detailed information on how to evaluate a variety of equipment, the reader is directed to a publication entitled, *A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields*, NCRP Report No. 119, published by the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD, 20814-3095.

1. Mobile Two-Way Equipment

Vehicle-mounted two-way radio equipment typically operates at transmitter powers of 110 watts or less. Even when considering that the antenna may increase the effective radiated power to as much as 400 watts, the potential for exposure in excess of the FCC MPE limits is low, especially given that the transmit time for these units is normally of short duration. The greatest concern is that people can easily be very close to the antenna or even be touching it while the transmitter is in operation.

To reduce the risk of excessive exposure to occupants of the vehicle, the antenna should be mounted as far from the occupants as possible. Ideally, roof-mounted antennas provide a great degree of protection because the roof acts as a shield to the radio frequency energy and the antenna radiation pattern, which is horizontally outward from the antenna, minimizes the radiation in the direction of the occupants. If the antenna cannot be mounted on the roof of the vehicle, then an alternative is to mount the antenna on the trunk lid or rear fender as far from the occupants as possible. (Exceptions and reconsideration to use of a trunk lid or rear fender mount is the use of mobile data, which could increase the duration of a transmission.) In general, if the antenna is at least three feet from an occupant, the risk of excessive exposure is minimal. Mounting the antenna on a rear surface of the vehicle does, however, place the center of radiation of the antenna essentially at the same level as the head and upper body portions of occupants. Occupants in the back seat of an automobile are at greatest risk due to the proximity of the antenna.

Some installations utilize concealed antennas to minimize public awareness of the vehicle. These antennas are sometimes mounted inside the vehicle on the front or rear window. Use of these antennas should be limited, as the radio frequency energy is being radiated inside the vehicle at distances very near the occupants.

To assure the safety of the occupants of a vehicle, it is preferable to make measurements inside a vehicle once all of the radio transmitting equipment has been installed. To make the

measurements, all transmitters in the vehicle should be activated while making RF level measurements as numerous points inside the vehicle. The measurements are particularly important because some parts of the vehicle, such as the steering wheel, can be resonant at the transmitting frequency and reradiate energy. The only way to know the actual effects of the RF energy inside the vehicle is to make the measurements. If hot spots are found, it may be necessary to reposition the antenna(s) to reduce RF levels. In the alternative, signs could be posted inside the vehicle to warn operators to limit the duration of transmissions.

When operating mobile equipment, care should be taken to assure that no one outside the vehicle is within three feet of the transmitting antenna before activating the transmitter. Even more importantly, make sure no one is touching the antenna. Direct contact with the radiating element of the antenna could potentially cause burns that could occur almost instantaneously.

2. Portable (hand-held) Two-Way Equipment

Hand-held portable two-way equipment has become a necessity for public safety workers. These units provide essential communications capability from wherever a worker may be. Rarely would one of these units operate above the five watt power level for a variety of reasons, including conservation of battery life. Antennas may be either of the telescoping metal rod variety or, more typically, a wire spiral antenna encased in rubber or plastic (“rubber duckie” antenna). Because of the relative low power levels and short transmit cycles, the chances of exceeding FCC guidelines for RF exposure for these radios is minimal.

When operating hand-held radios, especially those which have transmit powers in excess of five watts and which operate above 400 MHz, care should be taken to maximize the distance between the transmit antenna and the body. For example, a hand-held radio being held in front of the face should be positioned such that the antenna is slanted away from the head and body, maximizing the distance between the tip of the antenna and the body.

Some agencies allow or require workers to wear portable radios either on their belts or affixed to clothing, such as a shirt. In these cases, the transmit antenna can be very close to the body or even touching the body with only the fabric of the clothing between the antenna and the body. Again, because of the low power levels and short duration of transmissions, it is unlikely that FCC guidelines would be exceeded. If for any reason transmission times should increase significantly, the radio should be moved away from the body for the duration of the lengthy transmission. As a rule of thumb, any transmission of one minute or longer in duration should be cause to consider moving the radio away from the body.

3. Speed-measuring Equipment (Speed Radar)

Speed measuring radar equipment most generally operates in the 10, 24, and 35 GHz bands at power levels of 100 milliwatts or less. The NRCP recommends that no part of the body should be closer than 30 cm from the radiating end of the device, or said another way, from the front of the device. In practice, it is a good idea to be totally in back of the device, as the radiated beam can diffuse somewhat to the sides. Short exposures in front of the device, for example to calibrate the device, should not be harmful. In addition, because the eyes may be particularly susceptible to radio frequency energy at these frequencies, one should never look into the front of

the device at close range while it is operating.

Conclusion

The procedures described herein are intended to provide a safe work environment for those who have to work near RF transmission equipment and for the general public. For any plan to be fully effective, each responsible individual must exercise reasonable judgment for the particular site under consideration. If there are any question that arise about a particular site or the FCC requirements, questions can be directed to Radio Engineer at Commonwealth of Virginia's Department of Information Technology, 110 S 7th Street - Third Floor, Richmond, Virginia 23219.

Attachments

- A. October 21 letter from PCIA President Jay Kitchen to Dr. Robert Cleveland, FCC
- B. Dr. Cleveland's reply
- C. Applicable FCC Rules and Regulations
- D. Commonwealth of Virginia Site Data Sheet

PCIA Logo

COPY

October 21, 1997

Dr. Robert F. Cleveland
Standards Development Branch
Allocations and Standards Division
Office of Engineering & Technology
Federal Communication Commission
2000 M Street, N.W.; Room 480
Washington, D.C. 20554

Re: Evaluating Compliance with FCC Guidelines for Human Exposure to
Radiofrequency ("RF") Electromagnetic Fields

Dear Dr. Cleveland:

The Personal Communications Industry Association ("PCIA"), behalf of the entire personal wireless industry, wishes to thank you and Jerry Ulcek for your patience and invaluable participation both at the "*RF*" *Compliance Workshop* in Dallas this past August 26 -28 and at the *PCS '97 Institute* educational session addressing RF compliance. As shown by the strong turnout at both of these events, the wireless industry is approaching compliance with the new RF exposure regulations in a conscientious and diligent manner.

In the wake of your presentations and questions and answer sessions, many carriers have expressed some relief regarding the manageability of the compliance tasks at hand. In order to promote the fullest understanding of the new regulations, PCIA has reiterated below its understanding as to a number of specific compliance measures that the industry believes will be invaluable tools in performing the requisite routine evaluations. In particular:

! The new environmental regulations are exposure standards, not emissions standards, and therefore electric field strengths, magnetic field strengths, and power densities in excess of the limits set forth in Table 1 of Section 1.1310 are permissible if measures are instituted at the site to ensure that the exposure of workers and the general public remain below the limits in that table.

COPY

- ! As with other licensee responsibilities, while ultimate responsibility for compliance rests with the licensee, compliance with the RF exposure regulations can be delegated to specialized consultants, site managers, or specific individuals within a company, and, as long as the delegation itself is reasonable a licensee may certify compliance on the basis on the delegate's report.
- ! The triggering of the “routine evaluation” requirement does not require a licensee necessarily to engage in complex modeling or measurements, if the licensee is able to institute other controls, *e.g.*, the use of RF monitors and appropriate training within controlled environments, to ensure that exposures do not exceed the limits in Table 1 of Section 1.1310.
- ! Taking measures to control access to building rooftops, through the use of door locks and limiting key distribution to authorized personnel, in conjunction with appropriate signs and RF training to create an awareness of the risks of RF exposure, are generally sufficient to create a “controlled environment” on a building rooftop.
- ! In areas where physical access controls are impractical (*e.g.*, on a ladder) or illegal (*e.g.*, fire codes prohibiting locked doors), a controlled environment may nonetheless be created if signs are posted restricting access to authorized personnel, if signs are posted creating an awareness of the potential for RF fields in excess of the general population limits, and if the licensee utilizes door alarms or other similar measures to prevent trespass.
- ! Within a controlled area, if appropriate, the use of signs and other obvious barriers and demarcations around “hot spots” where emissions exceed the controlled environment limits can be an effective means to ensure site compliance.
- ! Within a controlled area, the use of appropriate training, personal RF monitors, and “work breaks” away from RF transmitters to reduce time-averaged exposure below the limits of Table 1 in Section 1.1310 can be an effective means to ensure compliance even if “hot spots” (areas where power densities exceed the limits in Table 1 of Section 1.1310) exist within a controlled area.
- ! Within a controlled environment, the use of RF protective suits to reduce RF exposure of workers with appropriate training can be an effective means to ensure compliance even if “hot spots” exist within the controlled area.

COPY

- ! Within a controlled environment at a multi-transmitter site, if a carrier can physically elevate its antenna so that, as a practical matter, the volume of space where the RF field exceeds 5 percent of the controlled environment limits in Table 1 of Section 1.1310 is 2 meters or more above any rooftop walkways (*i.e.*, the volume where the fields exceed 5 percent of the limit are practically inaccessible), that carrier would be relieved of any responsibility for ensuring compliance of all transmitters at the site. This assumes, of course, that the carrier does not exceed 5 percent of the general public exposure limit in any uncontrolled areas.

- ! A licensee may reduce the power of a transmitter to become categorically excluded, thereby relieving the licensee of the obligation to conduct a routine evaluation that includes considering the effects of nearby transmitters. While the categorical exclusion relieves a licensee of having to conduct a routine evaluation, it does not relieve the licensee from compliance with the RF exposure limits. Thus, if a licensee has reason to believe its facility may not comply with the exposure limits, notwithstanding a categorical exclusion, the licensee should undertake measures to reduce exposure in accordance with the FCC rules.

PCIA has restated its understanding of these points to ensure the Commission understands the types of compliance actions that carriers are beginning to undertake in order to ensure that they comply with the new RF regulations. PCIA understands that your office has significant responsibilities and that there are many demands on your time. PCIA nonetheless respectfully requests, to the extent any of these understandings appears to misstate the applicable requirements, that your office contact either Sheldon Moss at (703) 739-0300 x3311, or our counsel, Eric DeSilva at (202) 828-3182. Thank you in advance for your time and cooperation.

Respectfully yours,

E. "Jay" Kitchen, President

COPY

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

October 27, 1997

E. "Jay" Kitchen, President
Personal Communications Industry Association
500 Montgomery Street
Suite 700
Alexandria, VA 22314-1561

Dear Mr. Kitchen:

Thank you for your letter of October 21, 1997, concerning the PCIA's activities in response to the radio frequency compliance workshop held in Dallas in August attended by me and Jerry Ulcek. We are pleased to see that the PCIA is taking an active role in elaborating on the conclusions of the workshop to provide its members with further guidance on compliance with the FCC's new guidelines and policies for human exposure to radio frequency emissions

In our meeting with Sheldon Moss and Eric DeSilva on October 2, 1997, we discussed several issues related to compliance with the Commission's guidelines. As a result PCIA developed the compliance strategies and information contained in your October 21 letter to me.

Both Jerry Ulcek and I have reviewed the October 21 letter and the information it contains concerning compliance guidance and requirements. I believe that this information is accurate and should provide your members with important guidelines for meeting the FCC's new requirement in this area.

If you or your staff should have any additional questions or require further assistance, please feel free to contact either me or Jerry. We look forward to continuing to work with you and the staff at PCIA in the future in addressing these important issues.

Sincerely,

Robert F. Cleveland, Jr., Ph.D.
Office of Engineering and Technology
Federal Communications Commission

Applicable FCC Rules and Regulations

(47 C.F.R.)

1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

(b) In addition to the actions listed in paragraph (a) of this section, Commission actions granting construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities, require the preparation of an Environmental Assessment (EA) if the particular facility, operation or transmitter would cause human exposure to levels of radio frequency radiation in excess of the limits in §§ 1.1310 and 2.1093 of this chapter. Applications to the Commission for construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities must contain a statement confirming compliance with the limits unless the facility, operation, or transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(1) The appropriate exposure limits in §§ 1.1310 and 2.1093 of this chapter are generally applicable to all facilities, operations and transmitters regulated by the Commission. However, a determination of compliance with the exposure limits in § 1.1310 or 2.1093 of this chapter (routine environmental evaluation), and preparation of an EA if the limits are exceeded, is necessary only for facilities, operations and transmitters that fall into the categories listed in Table 1, or those specified in paragraph (b)(2) of this section. All other facilities, operations and transmitters are categorically excluded from making such studies or preparing an EA, except as indicated in paragraphs (c) and (d) of this section. For purposes of Table 1, "building-mounted antennas" means antennas mounted in or on a building structure that is occupied as a workplace or residence. The term "power" in column 2 of Table 1 refers to total operating power of the transmitting operation in question in terms of effective radiated power (ERP), equivalent isotropically radiated power (EIRP), or peak envelope power (PEP), as defined in 2.1 of this chapter. For the case of the Cellular Radiotelephone Service, Subpart H of Part 22 of this chapter; the Personal Communications Service, Part 24 of this chapter and the Specialized Mobile Radio Service, Part 90 of this chapter, the phrase "total power of all channels" in column 2 of Table 1 means the sum of the ERP or EIRP of all co-located simultaneously operating transmitters owned and operated by a single licensee. When applying the criteria of Table 1, radiation in all directions should be considered. For the case of transmitting facilities using sectorized transmitting antennas, applicants and licensees should apply the criteria to all transmitting channels in a given sector, noting that for a highly directional antenna there is relatively little contribution to ERP or EIRP summation for other directions.

Table 1. - Transmitters, Facilities and Operations Subject to Routine Environmental Evaluation

Experimental Radio Services (Part 5)	Power > 100 W ERP (164 W EIRP)
Multipoint Distribution K of Part 21)	Non-building-mounted antennas: height above Service (Subpart ground level to lowest point of antenna < 10 m and power > 1640 W EIRP Building-mounted antennas: power > 1640 W EIRP
Paging and Radiotelephone Service (Subpart E of Part 22)	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and power > 1000 W ERP (1640 W EIRP) Building-mounted antennas: power > 1000 W ERP (1640 W EIRP)
Cellular Radiotelephone Service (Subpart H of Part 22)	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m

	and total power of all channels > 1000 W ERP (1640 W EIRP) Building-mounted antennas: total power of channels > 1000 W ERP (1640 W EIRP)
Personal Communications Services (Part 24)	(1) Narrowband PCS (Subpart D): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP) Building-mounted antennas: total power of all channels > 1000 W ERP (1640 W EIRP) (2) Broadband PCS (Subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP) Building-mounted antennas: total power of all channels > 2000 W ERP (3280 W EIRP)
Satellite Communications (Part 25) General Wireless Communications Service (Part 26)	All included Total power of all channels > 1640 W EIRP
Wireless Communications Service (Part 27)	Total power of all channels > 1640 W EIRP
Radio Broadcast Services (Part 73)	All included
Experimental, auxiliary, and special broadcast and other program distributional services	Subparts A, G, L: power > 100 W ERP Subpart I: non-building-mounted antennas: height above (Part 74) ground level to lowest point of antenna < 10 m and power > 1640 W EIRP Building-mounted antennas: power > 1640 W EIRP
Stations in the Maritime Services (Part 80)	Ship earth stations only
Private Land Mobile Radio Services Paging Operations (Part 90)	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and power > 1000 W ERP (1640 W EIRP) Building-mounted antennas: power > 1000 W ERP (1640 W EIRP)
Private Land Mobile Radio Services Specialized Mobile Radio (Part 90)	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP) Building-mounted antennas: Total power of all channels > 1000 W ERP (1640 W EIRP)
Amateur Radio Service (Part 97)	Transmitter output power > levels specified in

§ 97.13(c)(1) of this chapter

Local Multipoint Distribution
Service (Subpart L of Part 101)

Non-building-mounted antennas: height above
ground level to lowest point of antenna < 10 m
and power > 1640 W EIRP

Building-mounted antennas: power > 1640 W
EIRP LMDS licensees are required to attach a
label to subscriber transceiver antennas that: (1) provides
adequate notice regarding potential radiofrequency safety
hazards, e.g., information regarding the safe minimum separation
distance required between users and transceiver
antennas; and
(2) references the applicable FCC-adopted
limits for radiofrequency exposure specified in § 1.1310
of this chapter

(2) Mobile and portable transmitting devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services (PCS), the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services (ship earth stations only) and the Specialized Mobile Radio Service authorized under Subpart H of Parts 22, 24, 25, 26, 27, 80, and 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, as specified in §§ 2.1091 and 2.1093 of this chapter. Unlicensed PCS, unlicensed NII and millimeter wave devices are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, as specified in §§ 15.253(f), 15.255(g), and 15.319(i) and 15.407(f) of this chapter. All other mobile, portable, and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure under §§ 2.1091 and 2.1093 of this chapter except as specified in paragraphs (c) and (d) of this section.

(3) In general, when the guidelines specified in § 1.1310 are exceeded in an accessible area due to the emissions from multiple fixed transmitters, actions necessary to bring the area into compliance are the shared responsibility of all licensees whose transmitters produce, at the area in question, power density levels that exceed 5% of the power density exposure limit applicable to their particular transmitter or field strength levels that, when squared, exceed 5% of the square of the electric or magnetic field strength limit applicable to their particular transmitter. Owners of transmitter sites are expected to allow applicants and licensees to take reasonable steps to comply with the requirements contained in § 1.1307(b) and, where feasible, should encourage co-location of transmitters and common solutions for controlling access to areas where the RF exposure limits contained in § 1.1310 might be exceeded.

(i) Applicants for proposed (not otherwise excluded) transmitters, facilities or modifications that would cause non-compliance with the limits specified in § 1.1310 at an accessible area previously in compliance must submit an EA if emissions from the applicant's transmitter or facility would result, at the area in question, in a power density that exceeds 5% of the power density exposure limit applicable to that transmitter or facility or in a field strength that, when squared, exceeds 5% of the square of the electric or magnetic field strength limit applicable to that transmitter or facility.

(ii) Renewal applicants whose (not otherwise excluded) transmitters or facilities contribute to the field strength or power density at an accessible area not in compliance with the limits specified in § 1.1310 must submit an EA if emissions from the applicant's transmitter or facility results, at the area in question, in a power density that exceeds 5% of the power density exposure limit applicable to that transmitter or facility or in a field strength that, when squared, exceeds 5% of the square of the electric or magnetic field strength limit applicable to that transmitter or facility.

(4) Transition Provisions. Applications filed with the Commission prior to October 15, 1997, (or January 1, 1998, for the Amateur Radio Service only), for construction permits, licenses to transmit or renewals thereof, modifications in existing facilities or other authorizations or renewals thereof require the preparation of an

Environmental Assessment if the particular facility, operation or transmitter would cause human exposure to levels of radio frequency radiation that are in excess of the requirements contained in paragraphs (b)(4)(i) through (b)(4)(iii) of this section. In accordance with § 1.1312, if no new application or Commission action is required for a licensee to construct a new facility or physically modify an existing facility, e.g., geographic area licensees, and construction begins on or after October 15, 1997, the licensee will be required to prepare an Environmental Assessment if construction or modification of the facility would not comply with the provisions of paragraph (b)(1) of this section. These transition provisions do not apply to applications for equipment authorization or use for mobile, portable and unlicensed devices specified in paragraph (b)(2) of this section.

(i) For facilities and operations licensed or authorized under Parts 5, 21 (Subpart K), 25, 73, 74 (Subparts A, G, I, and L), and 80 of this chapter, the "Radio Frequency Protection Guides" recommended in "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz", (ANSI C95.1-1982), issued by the American National Standards Institute (ANSI) and copyright 1982 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York shall apply. With respect to Subpart K of Part 21 and Subpart I of Part 74 of this chapter, these requirements apply only to multipoint distribution service and instructional television fixed service stations transmitting with an equivalent isotropically radiated power (EIRP) in excess of 200 watts. With respect to Subpart L of Part 74 of this chapter, these requirements apply only to FM booster and translator stations transmitting with an effective radiated power (ERP) in excess of 100 watts. With respect to Part 80 of this chapter, these requirements apply only to ship earth stations.

(ii) For facilities and operations licensed or authorized under Part 24 of this chapter, licensees and manufacturers are required to ensure that their facilities and equipment comply with IEEE C95.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." Measurement methods are specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields--RF and Microwave." Copies of these standards are available from IEEE Standards Board, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. Telephone: 1-800-678-4333. The limits for both "controlled" and "uncontrolled" environments, as defined by IEEE C95.1-1991, will apply to all PCS base and mobile stations, as appropriate.

(iii) Applications for all other types of facilities and operations are categorically excluded from routine RF radiation evaluation except as provided in paragraphs (c) and (d) of this section.

(5) Existing transmitting facilities, devices and operations: All existing transmitting facilities, operations and devices regulated by the Commission must be in compliance with the requirements of paragraphs (b)(1) through (b)(3) of this section by September 1, 2000, or, if not in compliance, file an Environmental Assessment as specified in § 1.1311.

1.1310 Radio frequency radiation exposure limits. - The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio frequency Radiation."

NOTE to Introductory Paragraph: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

Table 1. - Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density mW/cm ²	Averaging Time (minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	---	---	f/300	6
1500-100,000	---	---	5	6

(B) Limits for General Population/Uncontrolled Exposure

0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100,000	---	---	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

EQUIPMENT/ANTENNA DATA SHEET
(Use separate sheet for each station and additional pages, if necessary.)

Site Location: _____

Site Manager: _____

Type of Site (Tower, Rooftop, etc.): _____ FCC Tower ID: _____

Call sign of Station: _____ Frequency: _____ MHz

Is station *categorically excluded* from certification: _____ (yes or no)(See FCC Bulletin OET 65)

Licensee Name: _____

Radio Service: _____ (paging, SMR, cellular, business, etc.)

Transmitter Power Output: _____ watts Emission Type: _____

Antenna Type: _____
(If antenna is directional, please supply vertical and horizontal radiation patterns)

Antenna Gain: _____ dB Loss Between Transmitter and Antenna: _____ dB

Effective Radiated Power (ERP): _____ watts Antenna Length: _____ feet

Orientation of Antenna (if directional): _____ degrees (ref : true north)

Describe Any Beam-Tilt: _____

Height to Base of Antenna: _____ feet (Above ground for tower, above roof for rooftop. If a rooftop site, also please provide a "to-scale" drawing of the rooftop showing the location of the antenna and features of the roof, e.g. elevator penthouses, public areas like swimming pools, etc. Also, if there are other occupied structures within 500 feet of the edges of the rooftop, provide information to describe those structures, including height, distance, and direction from the site.)

Height to Tip of Antenna: _____ feet Polarization: _____ (vertical, horizontal, circular)

Have warning signs been posted at the site in accordance with FCC OET 65? _____ (yes or no)

Is site access limited to personnel trained in RF exposure hazards and abatement? _____ (yes or no)

Describe methods employed to limit access to the site by unauthorized personnel: _____

Contact person if more information is needed: _____

Phone: _____ Address: _____